

(Elect. Lett 34:22 (1998)). These rejections are respectfully traversed.

Claim 1 is directed to optical amplifier equipment that includes a Raman pump for producing Raman gain for optical data signals in a span of transmission fiber in a fiber-optic communications link. The Raman pump produces the Raman gain for the optical data signals using Raman pump light at first and second wavelengths.

An optical monitor is used to gather backscattered Raman pump light from the span of transmission fiber at the second wavelength.

A control unit uses the Raman pump and optical monitor to perform optical time-domain reflectometry measurements in a pump and probe arrangement. With this approach, the Raman pump light at the first wavelength serves as the "pump" and the Raman pump light at the second wavelength serves as the "probe." By modulating the Raman pump light at the first wavelength while pulsing the Raman pump light at the second pump wavelength, the control unit can measure the effects of adjusting the Raman gain produced by the Raman pump light at the first wavelength in the span of transmission fiber.

A significant advantage of applicants' approach is that the same two wavelengths of Raman pump light that are used to produce Raman gain for the optical data signals during normal

operation are also used as the "pump and probe" wavelengths during span characterization. This makes applicants' equipment less complicated than equipment in which extra sources are used to make characterizing measurements.

Nothing like applicants' claimed arrangement is shown or suggested by Ghera or Park.

Ghera describes an apparatus in which backscattered light from unspecified sources are used to make measurements in the Raman gain band or outside of the Raman gain band (see 150 and 160 in FIG. 1B of Ghera). Ghera also describes making measurements of back reflected light from a Raman pump (see 170 in FIG. 1B). As pointed out in the Office Action, Ghera's system may use a Raman pumping arrangement in which Raman gain is produced using one or more wavelengths or Raman pump light. However, Ghera says nothing about using a pump-and-probe arrangement of the type defined in claim 1 in which the pump and probe wavelengths are the same as the wavelengths used for generating Raman gain for the optical data signals in the span.

Park fails to make up for the deficiencies of Ghera.

With Park's approach, a tap 218 and photodiode 212 are used to make measurements of the data signals that are being used to carry traffic in a WDM system while Raman pump light is modulated. Like Ghera, Park fails to disclose a pump and probe arrangement using first and second Raman pump

wavelengths.

Park's arrangement uses one or more Raman pump lasers 402A, 402B, 402C, and 402D that may be modulated (e.g., at 10-1000 Hz) while photodiode measurements are being made with photodiode 212. This type of arrangement relies on the presence of data traffic. If no traffic is present (e.g., during system set-up procedures on dark fiber), no measurements can be made. Moreover, Park's approach interposes a tap (tap 218) in the signal path, which introduces undesirable attenuation in the data signal band.

In the Office Action, it was argued that it would have been obvious to modulate Ghera's Raman pumps using Park's approach. With an arrangement of the type disclosed in Park, Ghera's Raman pump light would be modulated at 10-1000 Hz while Ghera's signal traffic would be monitored to determine the effects of the pump modulation.

Even if this type of arrangement were to be used, it would not meet the limitations of claim 1. Claim 1 requires that the probe wavelength in the pump-and-probe arrangement be a Raman pump wavelength. There is nothing in Ghera, Park, or the proposed Ghera/Park combination that uses one Raman pump wavelength as a probe signal while using another Raman pump wavelength as a modulating pump signal. Claim 1 is therefore patentable whether or not Ghera and Park are combined.

Claim 2 depends from claim 1 and is patentable because claim 1 is patentable.

Because the prior art fails to teach applicants' claimed fiber-span characterization arrangement in which Raman pump light at first and second wavelengths is used in a pump-and-probe arrangement, claims 1 and 2 are in condition for allowance. This application is therefore in condition for allowance. Reconsideration and allowance of the application are respectfully requested.

Respectfully submitted,

  
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